

**MEETING SUMMARY
STAKEHOLDER ADVISORY GROUP
SOURCE WATER PROTECTION - SHIP BALLAST WATER
TREATMENT SYSTEMS**

**June 12, 2001
Alexandria, Virginia**

NSF International and the United States Environmental Protection Agency (USEPA) convened a meeting on June 12, 2001 in Alexandria, Virginia to discuss the ETV Source Water Protection Pilot Program and the incorporation of ship ballast water treatment technologies into this program. The meeting included representatives from the shipping industry, technology vendors, regulators, state agencies, university scientists/engineers researching ballast water and aquatic nuisance species issues, the United States Coast Guard (USCG), representatives from EPA, NSF International, and Battelle. A list of participants is provided as Attachment 1. The objectives of the meeting were to familiarize stakeholders with the overall ETV program and its role in the ballast water treatment systems evaluations. The meeting also reviewed current ballast water issues and solicited input from all potential stakeholders to assist in protocol development for testing ballast water treatment technologies. A final objective of the meeting was to gather information necessary for a testing program for commercial ready ballast water treatment technologies.

The morning session of the meeting consisted of several formal presentations by members of EPA, NSF International, USCG, NOAA and Michigan Department of Environmental Quality. During the afternoon, a formal Memorandum of Agreement (MOA) between the USCG and EPA was signed by Henry L. Longest, Acting Assistant Administrator of USEPA, Office of Research and Development, and Rear Admiral Paul J. Pluta, Assistant Commandant for the USCG Marine Safety and Environmental Protection. This agreement forms a partnership between the USCG and EPA's ETV Program to better facilitate the development of protocols for evaluating the capabilities of ballast water treatment systems and to provide a pathway to begin the development of regulatory procedures for approving ballast water treatment systems for installation on ships (Fact Sheet dated June 11, 2001: Ballast Water Agreement with the U.S. Coast Guard). Following the signing of the MOA, stakeholders were asked to provide input on which treatment technologies were commercially ready to enter the ETV program, as well as ideas on what verification factors and testing protocols are needed.

Overview of Presentations

EPA's ETV Program. The director of EPA's ETV program, Penny Hansen, presented an overview of the ETV program. The ultimate goal of the ETV program is to make better environmental technology available to protect human health and the environment with the immediate goal of providing information on how well current technologies actually perform. The ETV program evaluates (e.g. measures, estimates, tests) and verifies (e.g., confirms, substantiates) how well various treatment technologies perform given a specific

set of conditions and parameters. The ETV program does NOT certify (e.g., warranty or guarantee) any of the technologies it tests, and is not to be mistaken for an approval process.

The ETV program strives to provide a fair, high quality, credible process through which any commercially ready technology can be evaluated. After the evaluation is completed, testing information is made readily available to the public via the EPA-ETV website. The ETV program is a voluntary program designed for commercial-ready technologies and is not meant to test prototype or bench-scale technologies in the R&D phase. The program is not an approval process and will only give information on how a particular technology performs under a given set of conditions; no pass or fail status is rendered. It is important for vendors to realize this because for every technology that is tested, a report summarizing the performance of that technology is submitted and made publicly available. Therefore, vendors/developers need to carefully evaluate if the technology is ready to enter the ETV program. If a vendor believes the ETV verification process will help promote or sell the technology, the vendor generally enters the program. No one technology is judged to be above another (i.e., the ETV program levels the playing field), and all vendors are encouraged to enter into testing.

Because the testing of various treatment technologies can be expensive, the ETV program develops formal partnerships with private organizations, other federal agencies and state and local agencies. The need for verification of ballast water treatment technologies has prompted the USCG and ETV Program to enter into a partnership.

In addition to forming partnerships with private and government agencies, a key component of the ETV verification process is the formation of stakeholder groups. All vendors, shippers, or other parties that have interests in ballast water issues are considered stakeholders and are invited to participate. The stakeholders are key in identifying technological priorities as well as providing input on whether testing those technologies are practical. Stakeholders also are encouraged to provide input on development of protocols and test designs as well as identifying the verification factors that the protocol will address.

ETV's Source Water Protection Pilot Activities. NSF International is an independent, third party, not-for-profit organization dedicated to public health and the environment, and is a partner with EPA in the ETV program. Mr. Gordon Bellen of NSF International gave a very brief presentation of the mission and focus of the organization. Mr. Tom Stevens followed Mr. Bellen and discussed NSF International's role in the ETV Source Water Protection Pilot including the background, approach and current efforts. Following discussion with the USCG over the past several months, it was determined that ship ballast water treatment technologies should be considered in the Source Water Protection Pilot, and a stakeholder group should be formed to begin the process of identifying commercially ready ballast water treatment technologies and verification factors to be addressed. Mr. Stevens discussed the process of protocol development and stated the importance of the stakeholder group in providing input to this process. The initial draft protocol will be developed by Battelle, a subcontractor to NSF International, with

guidance from a Technology Panel consisting of a subset of stakeholders or other individuals with the technical expertise (scientists, engineers, ship architects etc.) in ballast water issues. Mr. Stevens also presented the critical elements of the test protocol and provided an overall summary of the testing process.

USCG Ballast Water Issues. Commander Scott Newsham of the USCG gave an overview of the USCG's Ballast Water Management Program. Commander Newsham presented a history of the ballast water regulations including the National Invasive Species Act (NISA) and how the USCG has responded and continues to respond to those regulations. Currently, the USCG has no approval system to address new ballast water treatment technologies and methods. They do, however, perform scientific audits and process evaluations. Audits are not independent tests for verification or approval purposes, but are aimed at evaluating the experimental design and testing methods (i.e. replication, quantification of condition variables and the biological context of the method). Process evaluations do evaluate the technology's ability to treat ballast water and its components, and examinations of filtration, ultraviolet radiation and hydrocyclonic separation are being conducted at the University of Miami (Florida) under a USCG R&D project. The USCG, along with the Smithsonian Environmental Research Laboratory (SERC) is continuing to investigate the effectiveness of mid-ocean exchange on reducing the potential of aquatic nuisance species invasions. They are also concerned with the issue of NOBOBs (No Ballast On Board) and are working with the Great Lakes Environmental Research laboratory (GLERL) to characterize NOBOB vessels. Another top priority of the USCG is the issue of ballast water treatment standards. Currently, the USCG is gathering information that will be useful for the development of such standards.

Ballast Water Treatment Standards Workshops. Dr. Robert Hiltabrand of the USCG Research and Development Center expanded on USCG's endeavors to consider ballast water standards. The USCG did not want to begin the formal process to develop standards but wanted to convene a group of scientists and engineers who are experts in the field of aquatic nuisance species and ballast water to discuss issues related to the development of ballast water standards. The USCG was interested in feedback from the scientific and engineering community as to whether development of a standard was feasible, and what research and recommendations the scientists/ engineers had regarding such standard development. The USCG contracted with Battelle to develop and conduct two workshops to begin investigating issues surrounding the development of a standard for ballast water. Results and recommendations from the workshops will be sent to the USCG HQ to help them determine future steps. Dr. Hiltabrand also mentioned that the USCG Research and Development Center would also participate in verification and certification issues. The USCG is currently gathering information on science and engineering facilities that can be used for testing and verification purposes.

NOAA's Ballast Water Technology Development Program. With the reauthorization of NISA, the Department of Commerce was given the authority to develop a Ballast Water Treatment Technology Program. Dr. Leon Cammen, program manager for NOAA's Ballast Water Technology Development Program, presented NOAA's efforts in the field of ballast water treatment technologies. This program is funded from several

sources and requests for proposals from this program are a joint venture between NOAA and the US Fish and Wildlife Service. Most of the projects currently funded are in process; therefore, no results were presented. Some of the projects currently supported through this program include research with UV, electrochemically-generated ozone, ultrasound, chemical disinfectants/organic biocides and dissolved air floatation. Several groups funded through the program have been evaluating primary and secondary ballast water treatment combinations. Several examples presented included the Northeast/Midwest Institute and Lake Carrier's Association group using barge and shipboard platforms in the Great Lakes to test the effectiveness of cyclonic separation and/or filtration followed by UV. Chesapeake Biological Lab/Maritime Solutions is also using a shipboard platform, the Cape May in Baltimore Harbor, to evaluate a combination of centrifugal separation followed by UV or chemical biocides.

Michigan's Current Activities in Ballast Water Treatment Technology. A final formal presentation was given by Mr. William McCracken of the Michigan Department of Environmental Quality (DEQ). Mr. McCracken presented some of the work currently being conducted in Michigan concerning ballast water treatment technologies. Michigan DEQ is receiving great pressure from the Legislature to "fix" the problem of aquatic nuisance species invasions in the Great Lakes. As such, DEQ established a workgroup to address aquatic nuisance species and ballast water issues. The workgroup concluded that ballast water management practices and biocides would be viable options for controlling aquatic nuisance species in the Great Lakes and are continuing research in this area. They are evaluating the effectiveness of three biocides (hypochlorite, copper ion, and glutaldehyde) to determine if these chemicals are lethal to a broad range of organisms found in ballast tanks. Studies are also addressing how these chemicals interact with sediments present in ballast tanks, whether they are corrosive to ballast tanks, and whether ballast water treated with these biocides is environmentally acceptable. DEQ is also evaluating whether the chemicals are simple and safe to use, and whether they are economical and readily available.

Prioritization of Treatment Technologies

The stakeholder group was asked what treatment technologies they felt were commercially available and ready for testing by the ETV. The group mentioned several technologies that fell into essentially two categories: separation technologies and kill/inactivation technologies. These technologies are listed below. The first four technologies were thought to be closest to being ready for testing.

1. Solid cyclonic separation followed by UV
2. Centrifugal separation followed by UV and two biocide dosing systems
3. Mechanical deoxygenation
4. Ozone
5. Filtration systems (general)
6. Chemical biocides (general)
7. Sonic

8. Thermal
9. Ballast water exchange

Although ballast water exchange is not considered a technology and would not be tested through the ETV program, there was a brief discussion regarding ballast water exchange testing. It was suggested that if a vendor was to develop a specific system or engineering design that would enhance the efficiency of ballast water exchange, then perhaps the ETV program could test it.

Verification Factors

In addition to identifying the technologies that are ready to enter into verification testing, the stakeholder group was also asked to provide input on the verification factors that need to be considered prior to development of the protocol. One verification factor is most certainly what type of performance indicators are necessary to verify that a technology actually does what it is intended to do. The verification factors must also address whether the equipment is effective at killing a wide range of species (e.g., microorganisms/viruses, microplankton, meroplankton, and holoplankton). Other verification factors that need to be considered are cost factors, operation and maintenance issues, and byproducts or residuals resulting from the treatment. The reliability of the equipment system was a concern and was discussed. The long-term effects of running the equipment may not show up in a short-term test. Therefore, testing protocols may have to consider the additional factors to address long-term issues such as how consistent the treatment system would be following months of intermittent or continuous use. The idea of dual treatment systems (i.e., multiple systems on one ship) was also raised, along with consideration of retrofitting existing ships with new technologies. Both of these issues may need to be factored into verification.

The consistency of performance of the treatment technology would need to be evaluated for different physical and chemical situations in both the short term and long term. Physical parameters of the water such as pH, turbidity, and transmittance will influence how a treatment system performs. The verification process needs to help identify the environmental "window" where the equipment works and does not work. The flow rates that would be necessary for ballasting also need to be considered. Flow rates can be highly variable and the question of whether the technology can handle very rapid loading of large volumes of water will be a concern for treatment technologies installed on ships. The point where the treatment is applied must also be considered for verification. Re-growth of organisms can be problematic if the treatment is only applied at intake. How to conduct monitoring in order to assess performance will also need to be addressed in the protocol.

Testing Protocol

To gather information on testing protocols, stakeholders were asked whether a single protocol or multiple protocols would be necessary for treatment technology verification. It was mentioned that any treatment technology needs to have one biological endpoint;

however, the protocols may need to be modified for treatment technologies that remove organisms compared to those that kill organisms. Duration of testing will need to be a consideration for the testing protocol. Testing over a typical ballast cycle and multiple ballast cycles may be required. Additionally, testing may be required during different times within the ballast water cycle including in-tank testing and testing on uplift and discharge. It was mentioned that perhaps a two-phase verification process would also be necessary. The immediate testing would address if the technology does perform as designed, while testing after a particular period of time has elapsed will be needed to address the reliability and efficiency of the system over time (i.e., effects of age on the system and operation and maintenance issues).

It was also suggested that testing be done under a range of source conditions (i.e., temperature, salinity, pH, etc.) and that a seasonal component may be necessary. The use of surrogates and natural populations of organisms for testing was also raised. Volumes of water to be treated and the variation in flow (due to variations in ship design) will also need to be addressed in the testing protocol. The testing protocol will also need to address the operating environment of the equipment. Stakeholders suggested that both full scale laboratory-based and shipboard testing will be necessary and that individual component and integrated systems will need to be considered. Other testing issues raised by the stakeholder group included management of residuals, NOBOB situations, and simultaneous testing with multiple vendors.

The stakeholder group was also asked if they have testing protocols already in place. If so, they were requested to forward these protocols to NSF International and Battelle for review and consideration when preparing the ETV protocol. Battelle will be working to develop the testing protocols and inclusion of adaptations and modifications of existing protocols would be beneficial.

Timeline

NSF International presented a draft timeline for steps necessary to get to the testing phase by the summer of 2002. First, and preferably by the end of June 2001, the Technology Panel must be formed. A meeting among Technology Panel members would need to occur immediately (i.e., July 2001) followed by a vendor meeting in September 2001. NSF International hopes to have a draft protocol by October 2001 with a Final draft protocol by January 2002. Following input from stakeholders and the Technology Panel, a final protocol could be implemented by April 2002, allowing testing to begin in June 2002.

ATTACHMENT 1
Attendance List
EPA ETV Source Water Protection Pilot
Stakeholder Meeting for
Ship Ballast Water Treatment Technologies

Participant	Organization Represented
Stephanie Barrett	ICF Consulting
Sarah Bauer	USEPA - ETV Program
Gordon Bellen	NSF International
Allison Blodig	Smith & Loveless
Will Browning	Browning Transport Management
Leon Cammen	NOAA - Sea Grant
Allegra Cangelosi	Northeast - Midwest Institute
Gloria Casale	Association of Teachers of Preventative Medicine
Marg Dochode	Great Lakes Fishery Commission
Lisa Drake	Old Dominion University - Department of Ocean, Earth and Atmospheric Sciences
Jennifer Field	Battelle
Ray Frederick	USEPA - Urban Watershed Management Branch
Judith Freeman	NOAA Chesapeake Bay Office
Robert Greco III	American Petroleum Institute
Sally Gutierrez	USEPA - Office of Research & Development
Penelope Hansen	USEPA - ETV Program
Rick Harkins	Great Lakes Carriers Association
Penny Herring	USCG - R&D Center
Robert Hiltabrand	USCG - R&D Center
Carlton Hunt	Battelle
Jim Hurley	USCG - R&D Center
Michael Jennings	Nutech O3, Inc.
Garth Jensen	South Florida Ocean Management Center
Lindy Johnson	NOAA - Office of International Law
Jeffrey Katersky	Inter Global Waste Management, Inc.
Tom Mackey	Hyde Marine
Joel Mandelman	Nutech O3, Inc.
Bill McCracken	Michigan Department of Environmental Quality
Mary Pat McKeown	USCG
Jean Montenarano	Naval Surface Warfare Center
Tracey Moriarty	Designers & Planners
Scott Newsham	USCG
Birgir Nilsen	OptiMarin A/S
Andrew Rogerson	Oceanographic Center, Nova Southeastern University

Robyn Rubenstein	Senator Ron Wyden
Jennifer Salerno	Booz Allen & Hamilton
John Sansalone	Louisiana State University
Dawn Schroeder	US Navy, NAVSEA, Naval Surface Warfare Center
Scott Smith	Washington Department of Fish & Wildlife
Greg Stapleton	USEPA - Office of Water
Tom Stevens	NSF International
Deborah Tanis	Battelle
Fred Tsao	US Navy
Tom Waite	University of Miami
Marianne Walch	Naval Surface Warfare Center
George Westall	Awsom Technologies, Inc.